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Emerging Standards in Synthetic Biology

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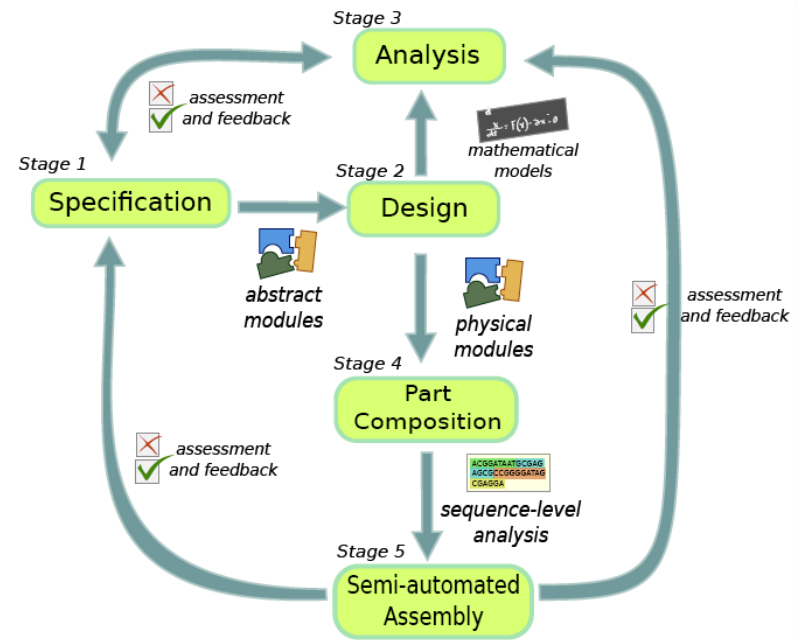
And the Synthetic Biology Data Exchange Working Group



Overall Aim of the Standardization Effort

Specifically:

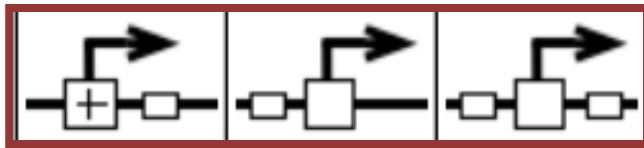
- To allow researches to **electronically exchange** designs with round-tripping.
- To send designs to **bio-fabrication centers** for assembly.
- To allow **storage** of designs in repositories and for **publication** purposes.



Synthetic Biology Data Exchange Group

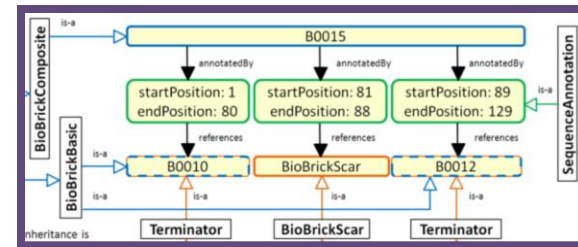
Synthetic Biology Open Language (SBOL)

<http://www.sbolstandard.org/>



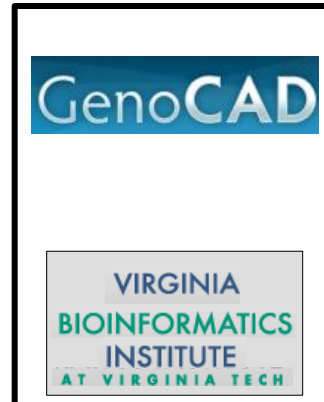
SBOL-visual

biofab

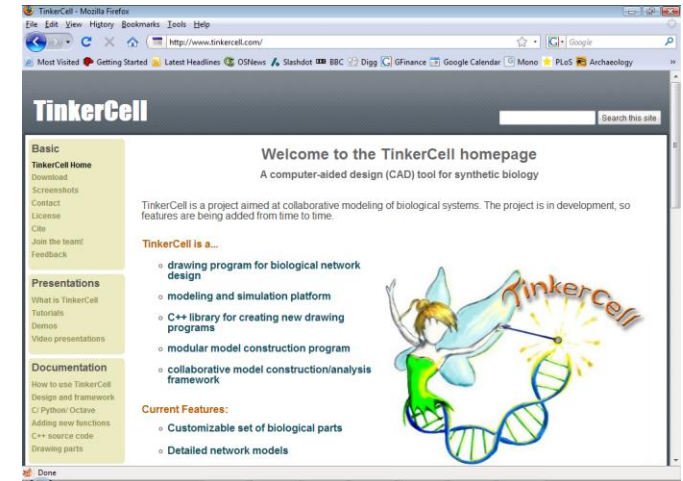
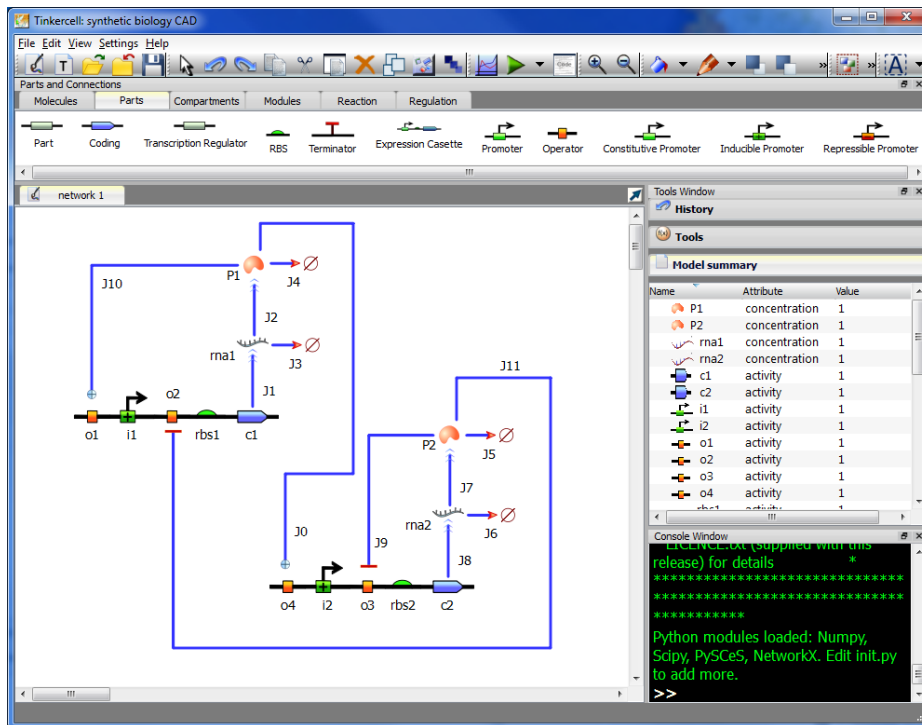


SBOL-semantic

UNIVERSITY of
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UW Efforts: A CAD system for Synthetic Biology called TinkerCell



www.tinkercell.com (Windows, Mac and Linux, released under BSD)
Contact author for details (dchandran1@gmail.com)

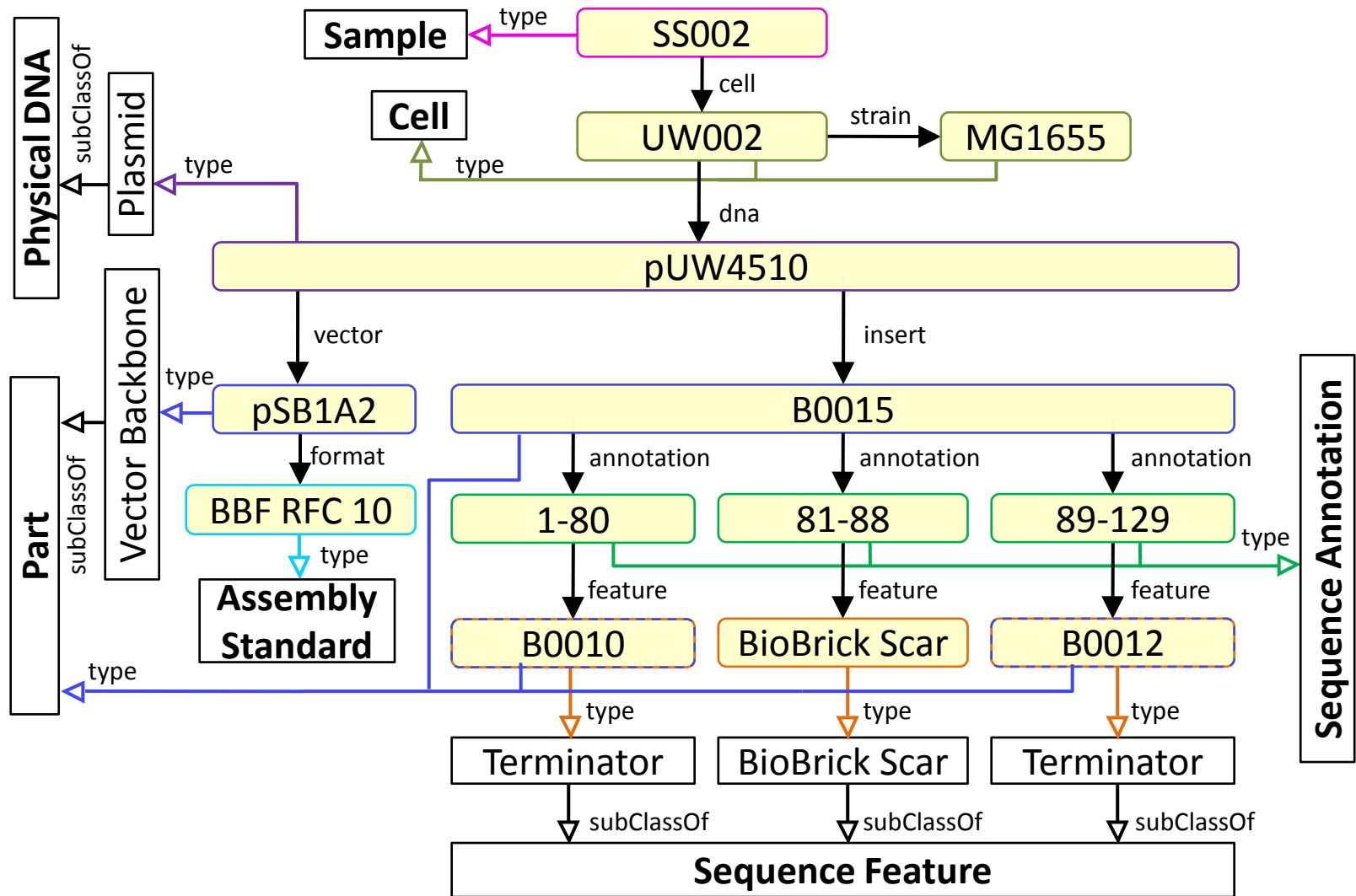


Figure 1. Diagram of the SBOL Semantic structure, illustrated with a set of information about a synthetic biology construct. **a.** A simplified *Class* (black rectangles) hierarchy (black open faced arrows) describes types (colored open faced arrows) of *Individual* data elements (yellow rounded rectangles) and the composition relationships between them (closed faced arrows). The example can be read as: Sample (pink) SS002 contains UW002 cells (dark green) of the MG1655 *E. coli* strain, which contain a plasmid (purple) pUW4510, which is composed of an parts (dark blue) an insert B0015 and vector backbone pSB1A2. The pSB1A2 vector backbone complies with the Assembly Standard (light blue) BBF RFC 10. The B0015 sequence annotations (green) specify three features (orange), the BioBrick Scar, and the parts (blue and orange indicating multiple inheritance), B0010 and B0012, which serve as transcriptional termination signals. **b.** Data type *Properties* used to hold information for each SBOL class follow the colon.

List of Software in the Working Group

- **Clotho (BU,Berkeley), Java**

Connects users to repositories of biological parts. Plugin tools then define the various functions that can be performed, mainly related to lab and parts managements.

- **GenoCAD (VT)**

Web based tool for the design of biological devices using an attribute grammar which defines the legal composition of parts.

- **iBioSim (Utah), Java**

Advanced simulation and analysis tool for synthetic and systems biology

- **JBEI Repository (Java), DOE support infrastructure**

- **SBOLr (Currently Python but moving to Java)**

Test parts repository, ~5000 parts

- **TinkerCell (UW), C++/Qt**

Extensible visual design tool with support for modules, eg simulation, annotation.

SBOLr is knowledge base of 5169 biological parts, used as a test database for the working group.

SBOLr

As of **Saturday 12th June 2010**
there are 5169 Parts available

Welcome, **Michal Galdzicki**

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#	Type	ID	Name	Summary	Owner				Stats	Created
1.	Part	UW_003503	BBa_S04137	heat sensitive cl QPI	Admin Semantic SBOL				0 0 0	01 Jan 2010
2.	Part	UW_003504	BBa_J52028	BBa_J52028	Admin Semantic SBOL				1 0 1	01 Jan 2010
3.	Part	UW_003505	BBa_S04055	Synthetic					0 0 0	01 Jan 2010
4.	Part	UW_003501	BBa_P1014	gentamicin					0 0 0	01 Jan 2010
5.	Part	UW_003502	BBa_I746220	AIP Detecto					0 0 0	01 Jan 2010
6.	Part	UW_003499	BBa_K143056	Promoter xy					0 0 0	01 Jan 2010
12.	Part	UW_003495	BBa_I14033	P(Cat)					0 0 0	01 Jan 2010

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BBa_I14033

1 GGCACGTAAGAGGTTCCAACCTTTCACCATAATGAAACA

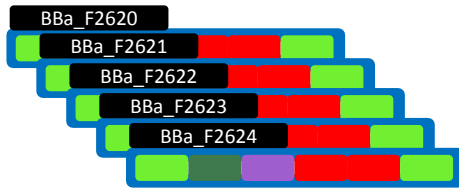
CCGTGCATTCTCCAAGGTTGAAAGTGGTATTACTTTGT

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<http://sbolr.bhi.washington.edu/>

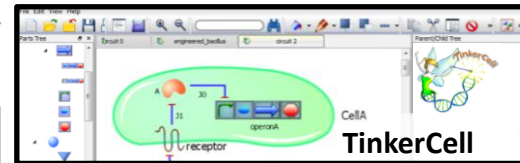
libSBOL: Supports SBOL format for other third-party tools

SBOL

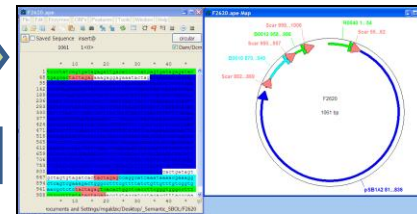


libSBOL

CAD Tool



Sequence Editor/Clotho



Laboratory Information/Clotho

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	AW	AX	AY	AZ	BA	BB	BC	BD	BE	BF	BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS	BT	BU	BV	BW	BX	BY	BZ	CA	CB	CC	CD	CE	CF	CG	CH	CI	CJ	CK	CL	CM	CN	CO	CP	CQ	CR	CS	CT	CU	CV	CW	CX	CY	CZ	DA	DB	DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	DO	DP	DQ	DR	DS	DT	DU	DV	DW	DX	DY	DZ	EA	EB	EC	ED	EE	EF	EG	EH	EI	EJ	EK	EL	EM	EN	EO	EP	EQ	ER	ES	ET	EU	EV	EW	EX	EY	EZ	FA	FB	FC	FD	FE	FF	FG	FH	FI	FJ	FK	FL	FM	FN	FO	FP	FQ	FR	FS	FT	FU	FV	FW	FX	FY	FZ	GA	GB	GC	GD	GE	GF	GG	GH	GI	GJ	GK	GL	GM	GN	GO	GP	GQ	GR	GS	GT	GU	GV	GW	GX	GY	GZ	HA	HB	HC	HD	HE	HF	HG	HH	HI	HJ	HK	HL	HM	HN	HO	HP	HQ	HR	HS	HT	HU	HV	HW	HX	HY	HZ	IA	IB	IC	ID	IE	IF	IG	IH	II	IJ	IK	IL	IM	IN	IO	IP	IQ	IR	IS	IT	IU	IV	IW	IX	IY	IZ	JA	JB	JC	JD	JE	JF	JG	JH	JI	IJ	JK	KL	KM	KN	KO	KP	KQ	KR	KS	KT	KU	KV	KW	KX	KY	KZ	LA	LB	LC	LD	LE	LF	LG	LH	LI	LJ	LK	LM	LN	LO	LP	LQ	LR	LS	LT	LU	LV	LW	LX	LY	LZ	MA	MB	MC	MD	ME	MF	MG	MH	MI	MJ	MK	ML	MM	MN	MO	MP	MQ	MR	MS	MT	MU	MV	MW	MX	MY	MZ	NA	NB	NC	ND	NE	NF	NG	NH	NI	NJ	NK	NL	NM	NN	NO	NP	NQ	NR	NS	NT	NU	NV	NW	NX	NY	NZ	OA	OB	OC	OD	OE	OF	OG	OH	OI	OJ	OK	OL	OM	ON	OO	OP	OQ	OR	OS	OT	OU	OV	OW	OX	OY	OZ	PA	PB	PC	PD	PE	PF	PG	PH	PI	PJ	PK	PL	PM	PN	PO	PP	PQ	PR	PS	PT	PU	PV	PW	PX	PY	PZ	QA	QB	QC	QD	QE	QF	QG	QH	QI	QJ	QK	QL	QM	QN	QO	QP	QQ	QR	QS	QT	QU	QV	QW	QX	QY	QZ	RA	RB	RC	RD	RE	RF	RG	RH	RI	RJ	RK	RL	RM	RN	RO	RP	RQ	RR	RS	RT	RU	RV	RW	RX	RY	RZ	SA	SB	SC	SD	SE	SF	SG	SH	SI	SJ	SK	SL	SM	SN	SO	SP	SQ	SR	SS	ST	SU	SV	SW	SX	SY	SZ	TA	TB	TC	TD	TE	TF	TG	TH	TI	TJ	TK	TL	TM	TN	TO	TP	TQ	TR	TS	TU	TV	TW	TX	TY	TZ	UA	UB	UC	UD	UE	UF	UG	UH	UI	UJ	UK	UL	UM	UN	UO	UP	UQ	UR	US	UT	UU	UV	UW	UX	UY	UZ	VA	VB	VC	VD	VE	VF	VG	VH	VI	VJ	VK	VL	VM	VN	VO	VP	VQ	VR	VS	VT	VU	VV	VW	VX	VY	VZ	WA	WB	WC	WD	WE	WF	WG	WH	WI	WJ	WK	WL	WM	WN	WO	WP	WQ	WR	WS	WT	WU	WV	WW	WX	WY	WZ	XA	XB	XC	XD	XE	XF	XG	XH	XI	XJ	XK	XL	XM	XN	XO	XP	XQ	XR	XS	XT	XU	XV	XW	XX	XY	XZ	YA	YB	YC	YD	YE	YF	YG	YH	YI	YJ	YK	YL	YM	YN	YO	YP	YQ	YR	YS	YT	YU	YV	YW	YX	YY	YZ	ZA	ZB	ZC	ZD	ZE	ZF	ZG	ZH	ZI	ZJ	ZK	ZL	ZM	ZN	ZO	ZP	ZQ	ZR	ZS	ZT	ZU	ZV	ZW	ZX	ZY	ZZ
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